

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

DropBooks

Occlusion



- In dentistry, the term occlusion refers to the way that the upper and lower teeth come together.
- Originally, the term "occlusion" meant just the way in which each individual tooth met with its mate in the opposite arch.

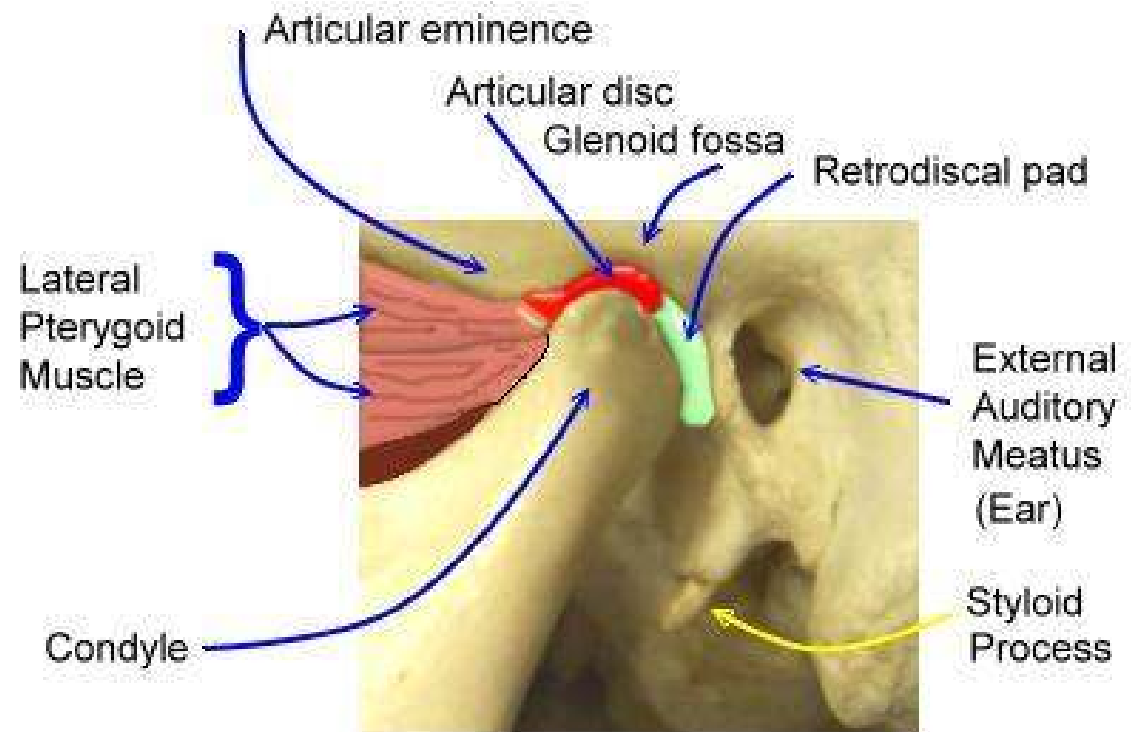
- In fact, occlusion is one of the most important factors in dentistry because the success or failure of practically everything a dentist does in a patient's mouth depends upon its ability to operate within the boundaries of the patient's physiologic occlusion. Even a simple filling that changes the way a patient bites can cause untold agony for the patient

The three most important factors that affect a patient's occlusion

- 1.** The first factor is the minute relationship of the upper and lower teeth when they come together
- 2.** The second factor is the exact relationship of the components of the temporo-mandibular joint (the TMJ).
- 3.** The third factor is the neuromuscular system

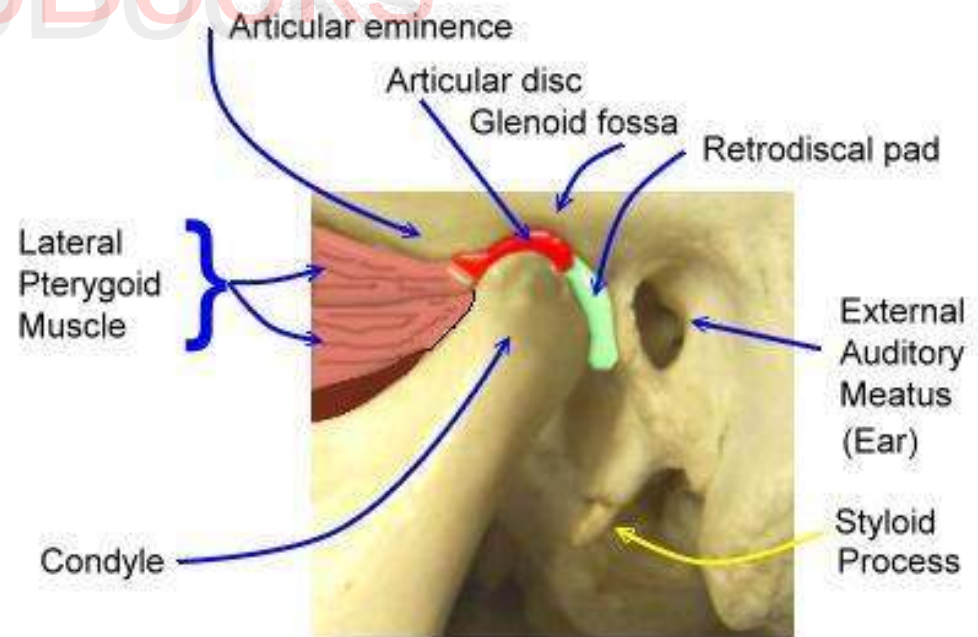
The temporo-mandibular joint (TMJ).

- The TMJ is the ball (condyle-part of the mandible) and socket (cranial base- part of the skull) joint that allows the lower jaw to swing open and closed.

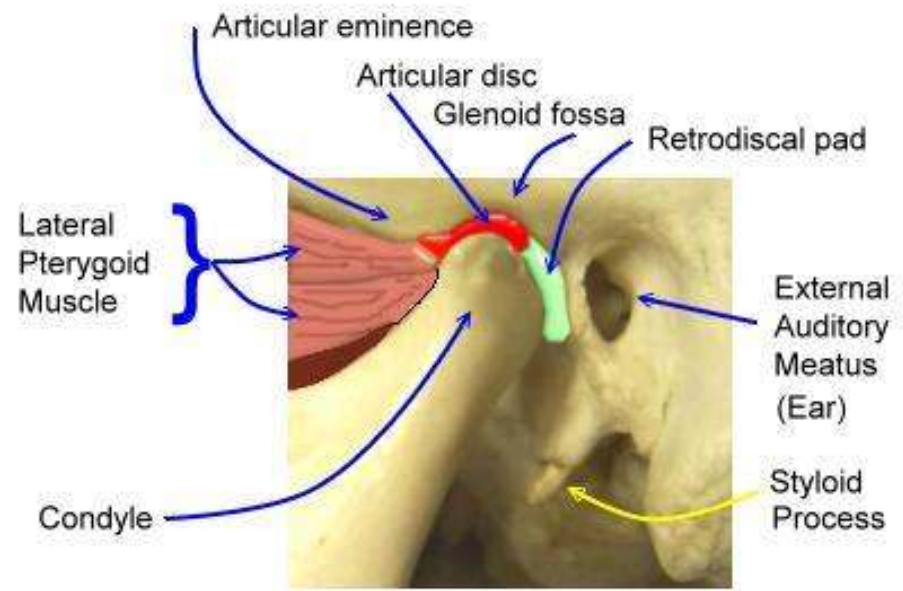


The components of the TMJ are as follows :

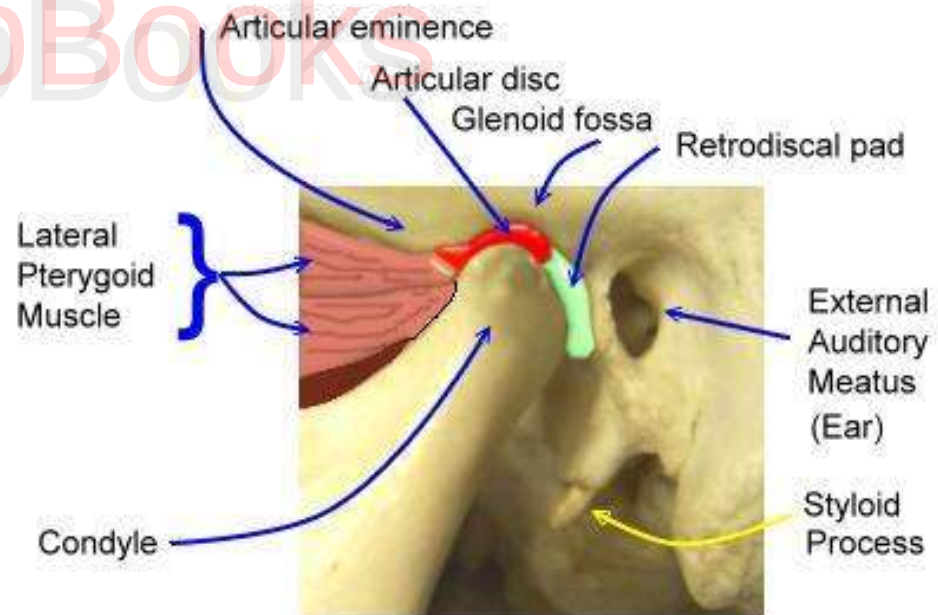
A- The **condyle**: This is the "ball" in the joint. It is a part of the mandible (lower jaw), and is covered in a layer of cartilage which allows for smooth motion within the joint assembly.



B- The **glenoid fossa**: The fossa is the "socket", or depression in which the condyle sits. It is located in the temporal bone of the skull. The glenoid fossa is also covered with a layer of cartilage which allows smooth activity in the joint.

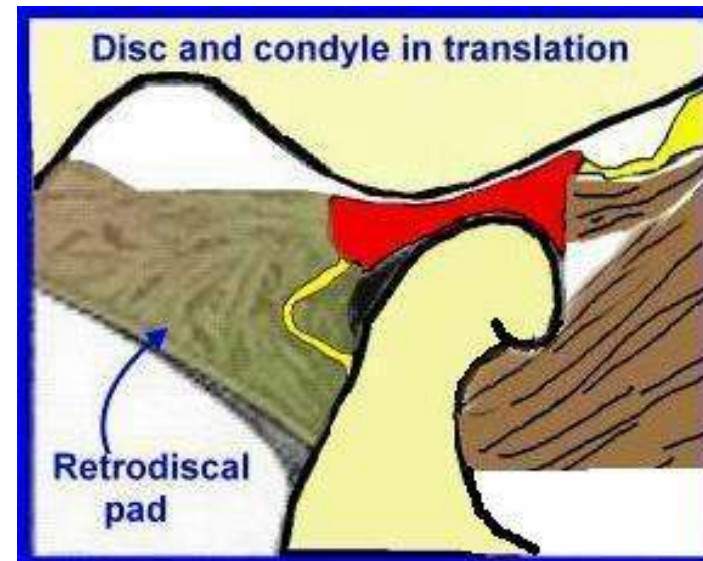
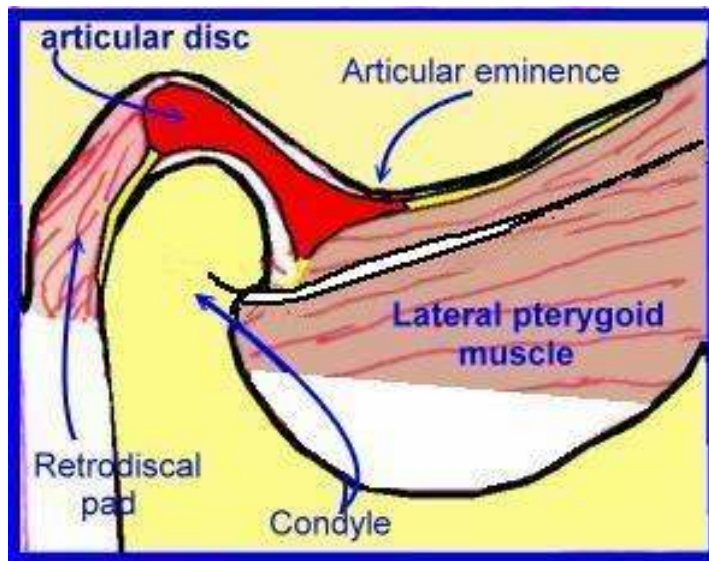


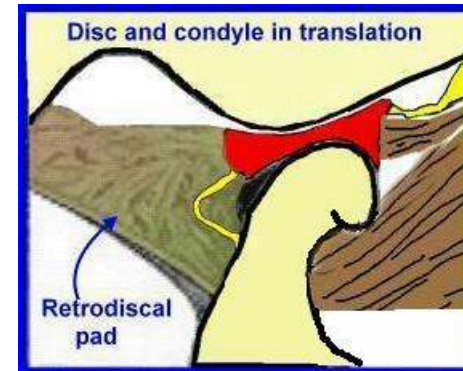
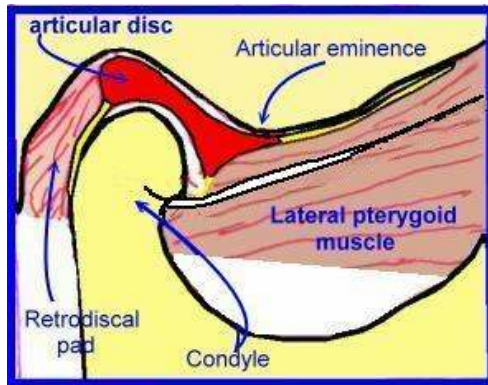
C-The articular disc It is made of hyaline cartilage. It has an indentation on the bottom side to accommodate the head of the condyle. The ligament behind it, is called the **retrodiscal pad** in deference to its function as a shock absorber for the condyle when the lower jaw is drawn back as far as it will go.



How the TMJ behaves during normal jaw opening?

- Each joint can be described as ginglymo-arthrodial, meaning that it is capable of both a hinging and a gliding articulation





- Note the muscle labeled "**lateral pterygoid**" in the image on the left above. This muscle has fibers which attach separately to the front of the articular disc, with the majority attaching to the neck of the condyle. When they contract, both the articular disc and the condyle are pulled forward in unison in order to affect translation of the condyle. When the condyle translates down the incline of the articular eminence, the articular disc follows.

- The disc is in red and the ligaments that attach it to the bony structures are represented in bright yellow. Notice that the disc is not rigidly attached to the head of the condyle. It remains on top of the condyle, but moves into new positions throughout the translation process. The thinnest part of the disc always remains between the closest points of contact between the articular eminence and the the condyle.

The damaged TM Joint (internal joint derangement)

If a patient forcefully bruxes (grinds or clenches the teeth), the entire masticatory system is placed under **great strain**. The teeth can **wear**.

The periodontium (gums and the bone that supports the teeth) may become inflamed, and in combination with poor hygiene, periodontal disease may result.

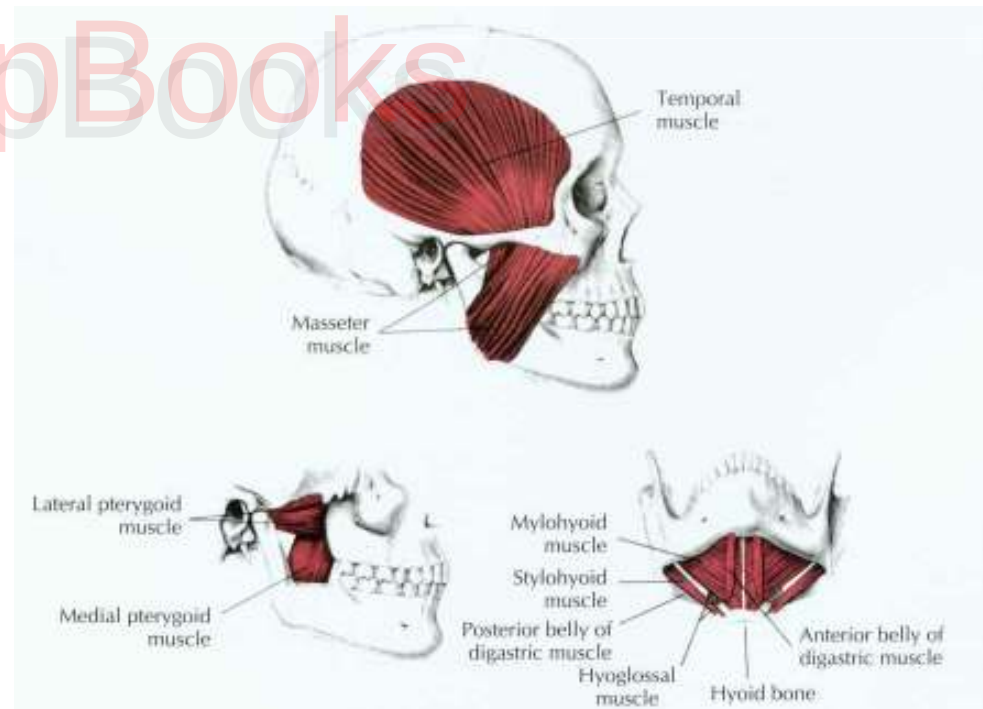
The TMJ is always placed under stress during bruxing, even if centric occlusion coincides with centric relation.

The neuromuscular system

- Several muscles are responsible for mandibular movements. These can be grouped into the **muscles of mastication** and the **suprahyoid muscles**

- The former include the temporal, the masseter, and the medial and lateral pterygoids;
- the latter the geniohyoid, the mylohyoid, and the digastrics.

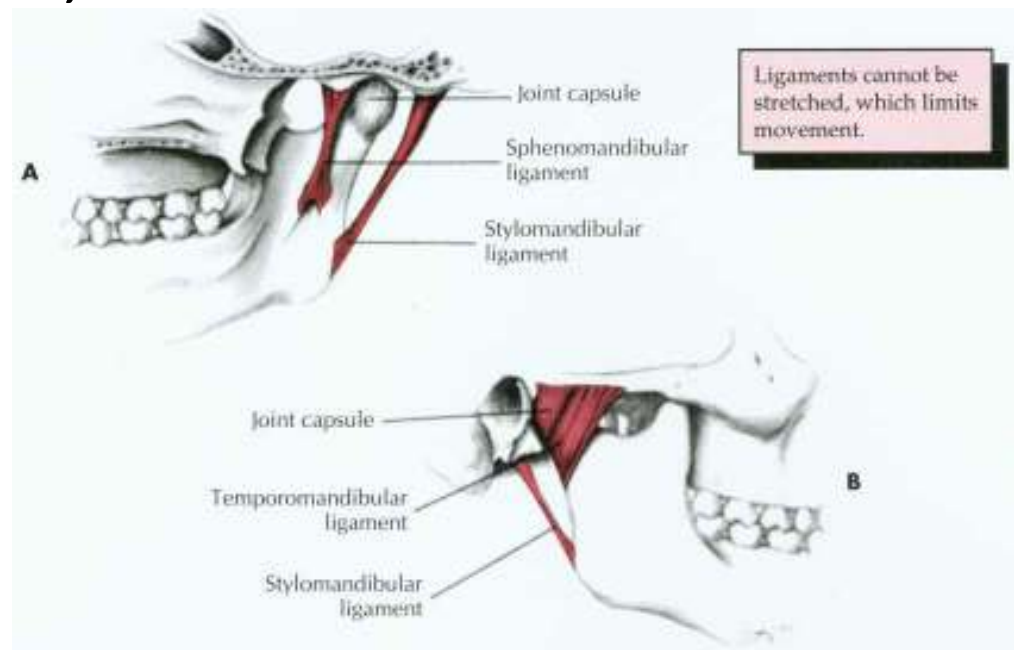
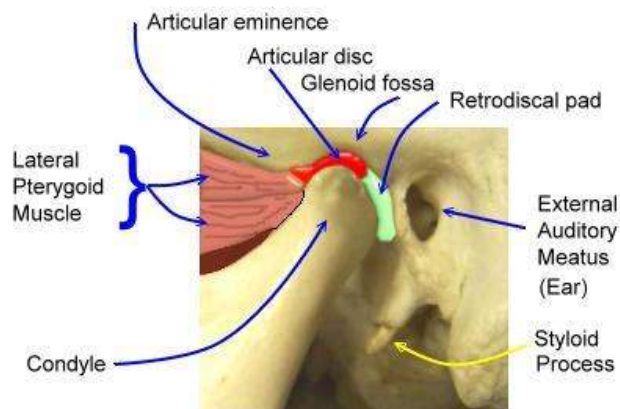
The muscles of mastication
and the suprahyoids



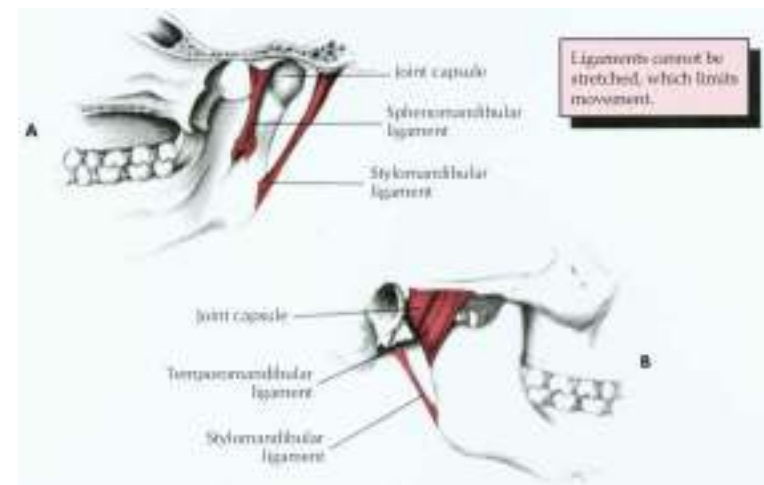
LIGAMENTS

- The body of the mandible is attached to the base of the skull by muscles and also by three paired ligaments

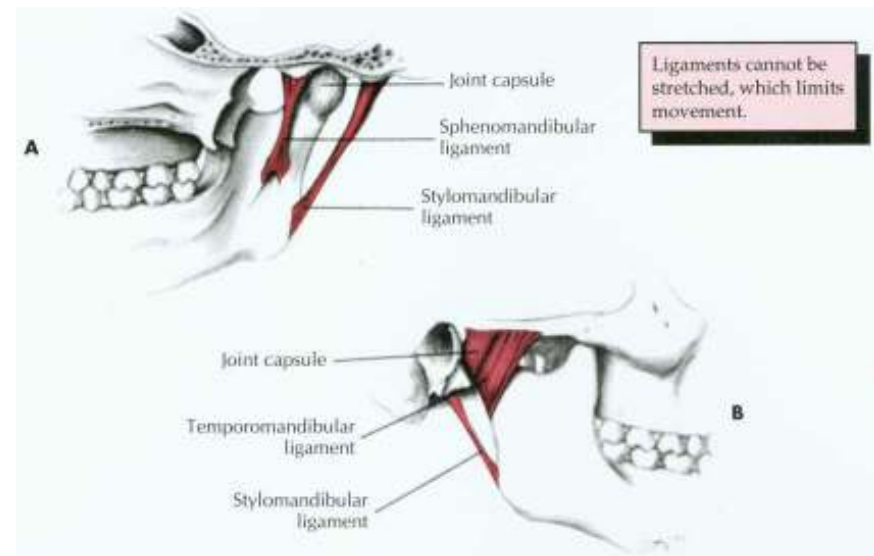
the **temporomandibular** (also called the lateral),
the **sphenomandibular**, and
the **stylomandibular**



- Ligaments cannot be stretched significantly, so they limit the movement of joints. The temporomandibular ligaments limit the amount of **rotation** of the mandible and protect the **structures** of the joint, limiting **border movements**.

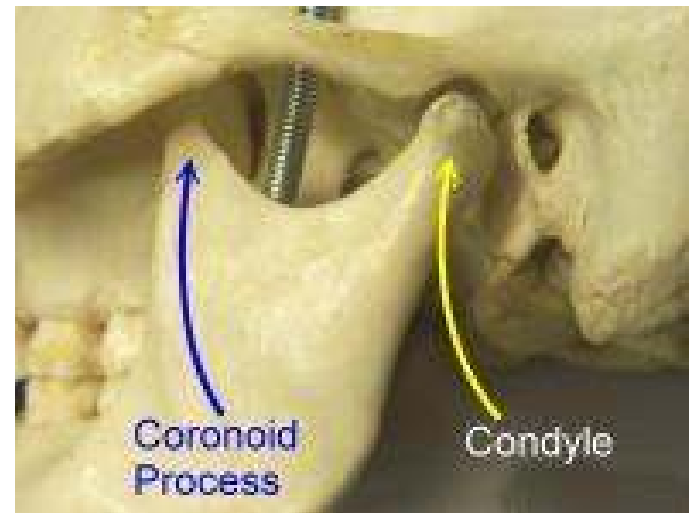


- The sphenomandibular and stylomandibular ligaments limit separation between the condylar process and the disk; the stylomandibular ligaments also limit protrusive movement of the mandible.

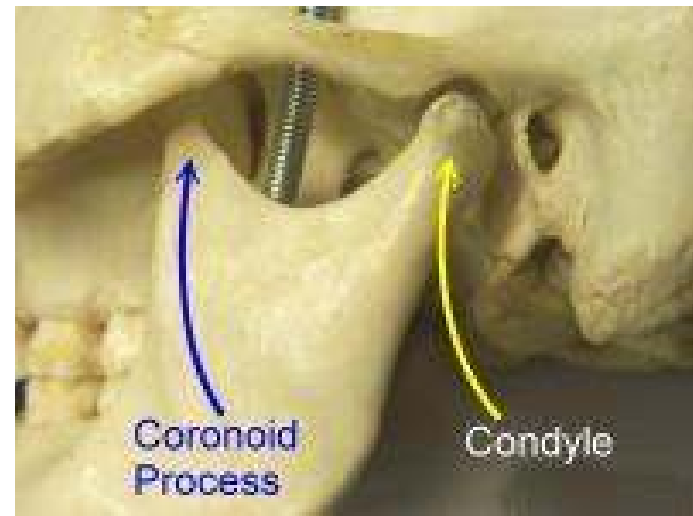


Centric Relation

- It is a bone-to-bone relation. It is the relation between the maxilla and the mandible when the condyles are in the rear most upper most mid most in glenoid fossa.
- More simply, it may be defined as the physiologic centering of the condyles in the cranium



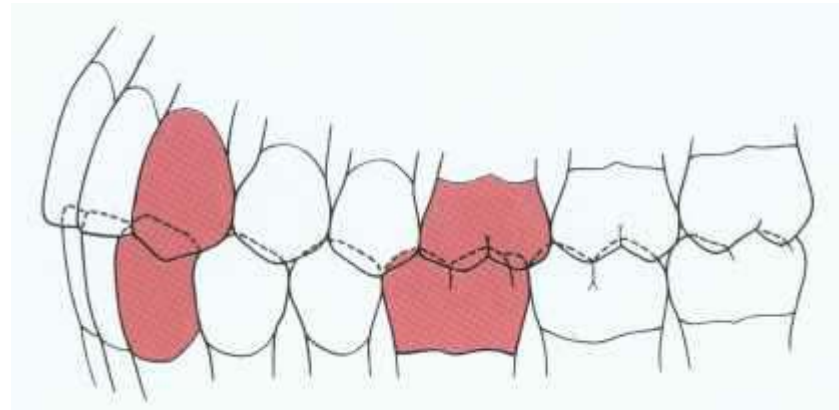
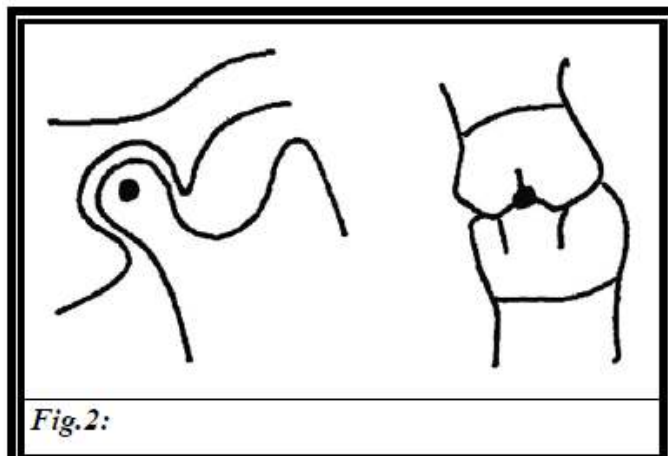
- Centric relation is considered the **optimal mandibular position** in which the bilateral condyle-disk assemblies are fully seated in their corresponding glenoid fossae, with the condyles positioned along the anterior slope of the articular eminence



- If the TM Joints are in a state of health, they tend to approximate this position whenever the teeth are slightly separated and the muscles of mastication are relaxed. Ideally, this position of the joints should also be approximated when the teeth are brought together into the patient's centric occlusion.

Centric occlusion

- **Centric occlusion** is the term used to describe the position of the lower jaw when the teeth are fully occluded (together). This varies from person to person depending upon the number and position of teeth in each jaw



- This position can change throughout a person's life depending on such factors as the **loss of teeth** (with the consequent shifting of the teeth that takes place after teeth are removed), **fractures of the jaw**, **orthodontic movement** of the teeth to new positions, or the shifting of the teeth due to the constant pressures from **bruxing** (generally unconscious habits of grinding or clenching)

- When the teeth are fully occluded, the condyle is forced into a specific position within the glenoid fossa.
- A patient's centric occlusion may be **physiologic**, meaning that the joint is placed into a comfortable position,
- or **pathologic**, meaning that the joint is forced into an eccentric position which may produce organic joint dysfunction.

Maximum Intercusption

- It is the most closed complete inter-digitation of mandibular and maxillary teeth irrespective of **condylar centricity**
- Maximum intercuspation may or may not coincide with centric occlusion, depending on the position of the condyle

If in maximum intercuspatation the condyles are physiologically centered, then both the maximum intercuspal position and the centric occlusion position are the same.

However, if maximum intercuspatation occurs with the condyles being out of centricity, then both positions would not coincide, with the maximum intercuspatation in that case, referred to as the habitual closure, and is considered as an **eccentric position**.

In that case the intercuspal position is in a position forward to the centric position, and at a lower vertical dimension.

Condylar Movements

1-Rotation

Rotation is the motion of a body around its axis.

Mandibular rotation occurs in the lower compartment of the TM J, between the mandibular Condyle and the articular disc.

Mandibular rotation occurs around the rotational centers of the condyles.

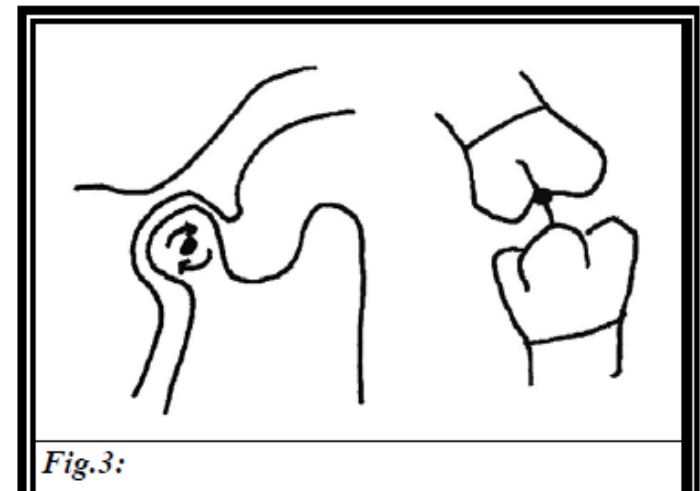
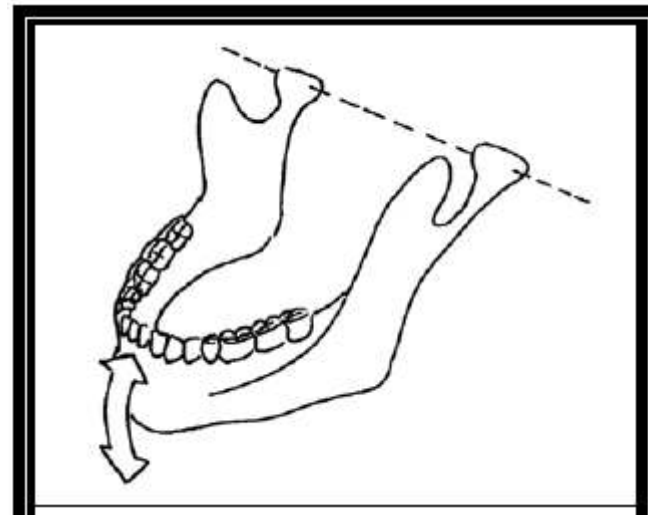


Fig.3:

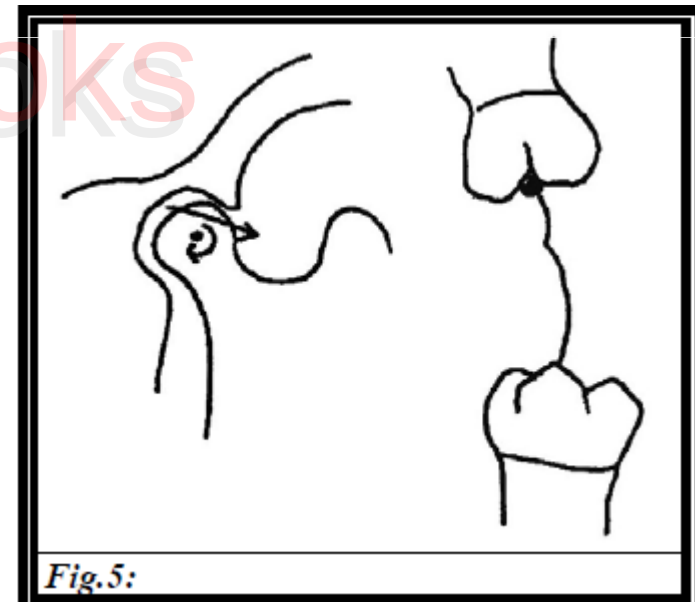
- The Hinge Axis: is the imaginary line connecting the rotational centers of one condyle with that of the opposite condyle, and around which the mandible makes the opening and closing rotational movements.



2-Translation

Translation is the movement of a body when all its parts move at the same time. Mandibular translation occurs in the upper compartment of the T M J between the disc and the glenoid fossa.

In mandibular translation, there is a change in the relationship of the condyle and its articular disc with the articular fossa.



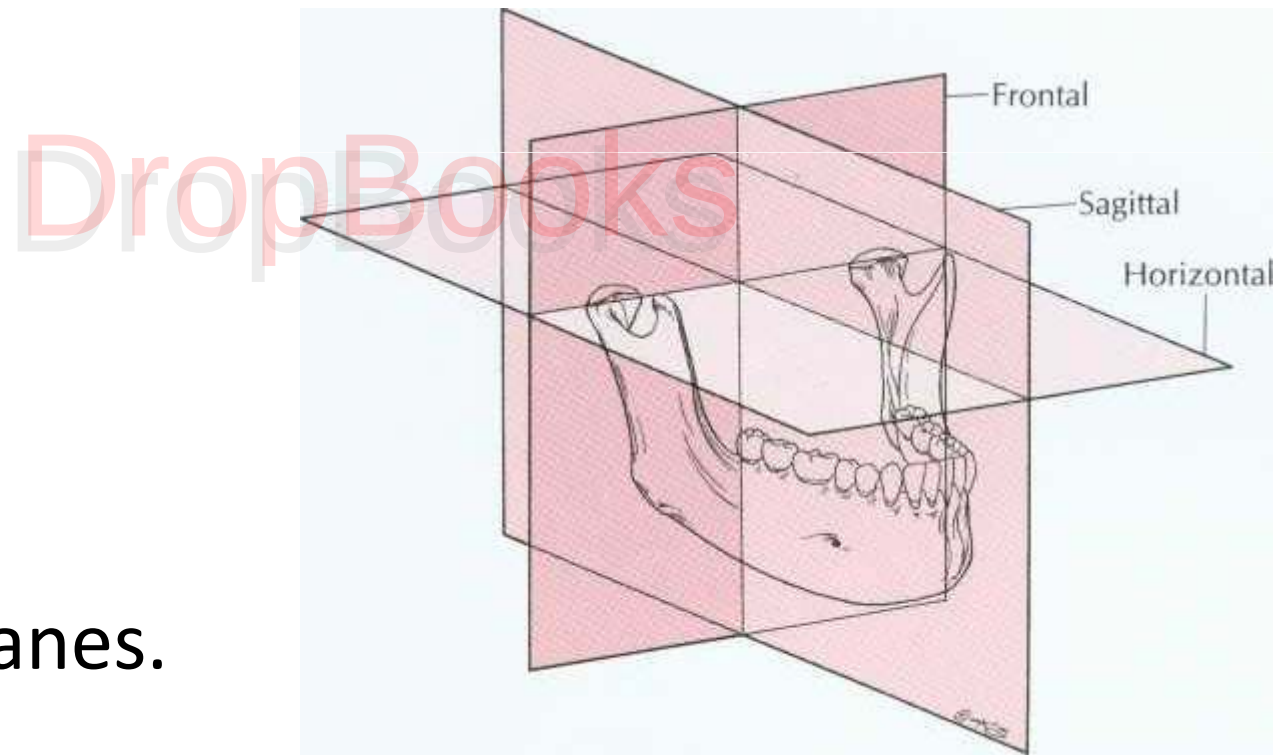
Mandibular Movement

As for any other movement in space, complex three-dimensional mandibular movement can be broken down into two basic components:

translation, when all points within a body have identical motion, and **rotation**, when the body is turning about an axis

Every possible three-dimensional movement can be described in terms of these two components.

- In addition, it is easier to understand mandibular movement when the components are described as projections in three perpendicular planes: sagittal, horizontal, and frontal

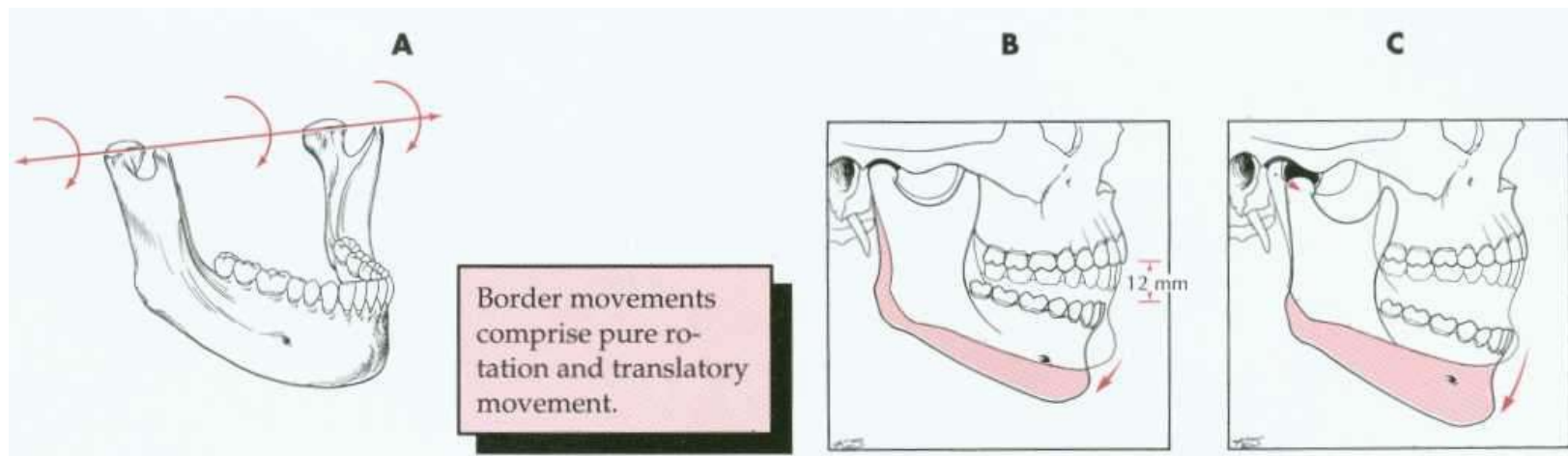


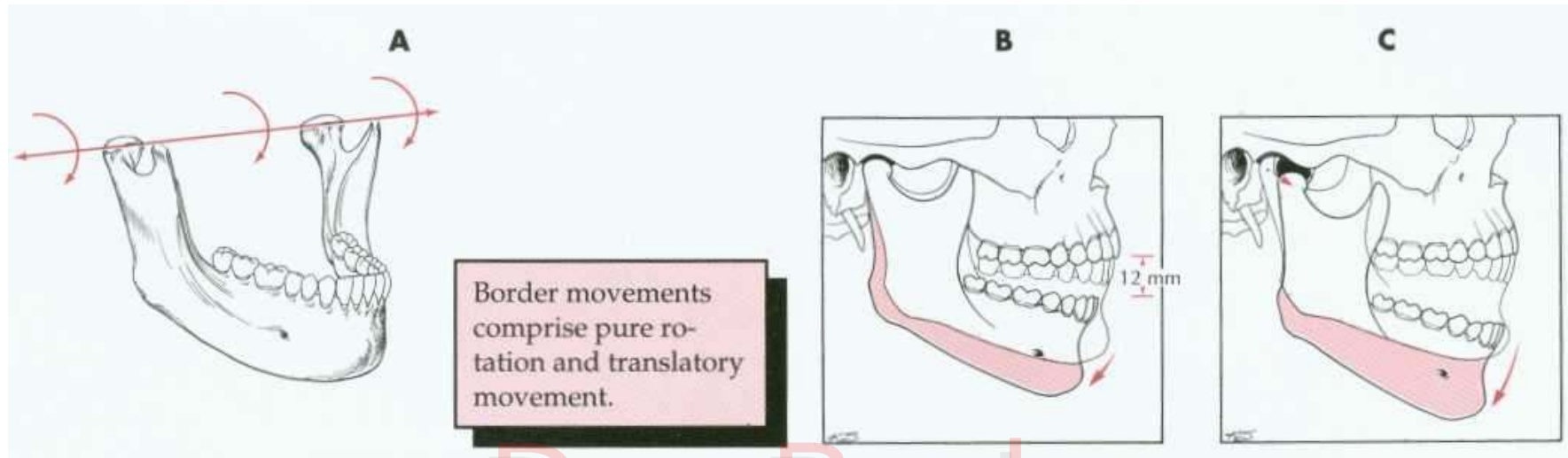
Reference planes.

1- In Sagittal Plane (Rotation around horizontal axis)

This movement, in the sagittal plane, happens when the mandible in centric relation makes

a purely rotational opening and closing border movement around the **transverse horizontal axis**, which extends through both condyles



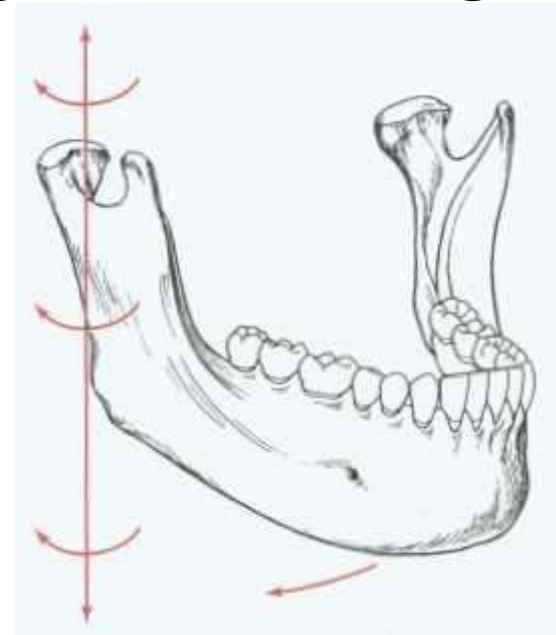


- A. Rotation of the mandible in a sagittal plane can be made around the terminal hinge axis.
- B. After about 12 mm of incisal opening, the mandible is forced to translate.
- C. Maximum opening; the condyles have translated forward.

2. In Horizontal Plane.(Rotation around Vertical axis) .

This movement occurs in the horizontal plane when the mandible moves into a lateral excursion. The center for this rotation is a vertical axis extending through the rotating of working-side condyle.

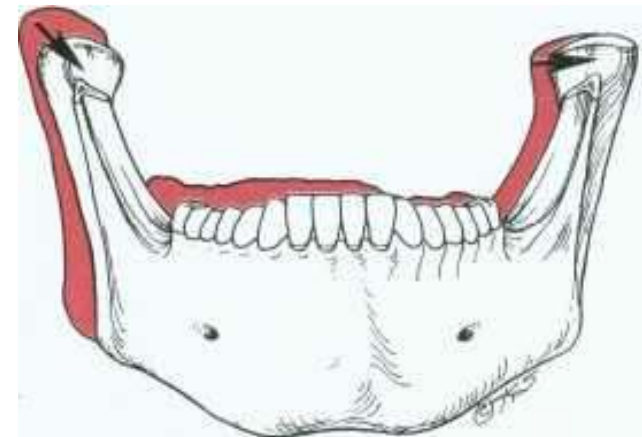
Rotation in the horizontal plane occurs during lateral movement of the mandible. (The vertical axis is situated in the condylar process.) Normally there is relatively little translation (sideshift



3. In Frontal Plane. (rotation around the sagittal axis

When observing a lateral movement in the frontal plane, the mediotrusive (or nonworking) condyle moves down and medially while the laterotrusive (or working) condyle rotates around the sagittal axis perpendicular to this plane

Lateral movement in the frontal plane.



In summary

Mandibular Movement

- In Sagittal Plane (Rotation around horizontal axis) **purely rotational and then translate.**
- In Horizontal Plane.(Rotation around Vertical axis) . **moves into a lateral excursion**
- In Frontal Plane. (rotation around the sagittal axis In non-working side condyle moves **down and medially.** In working side condyle **rotates**

Working Mandibular Movement

- With the condylar rotation and translation, the mandible is capable of performing the following movements:

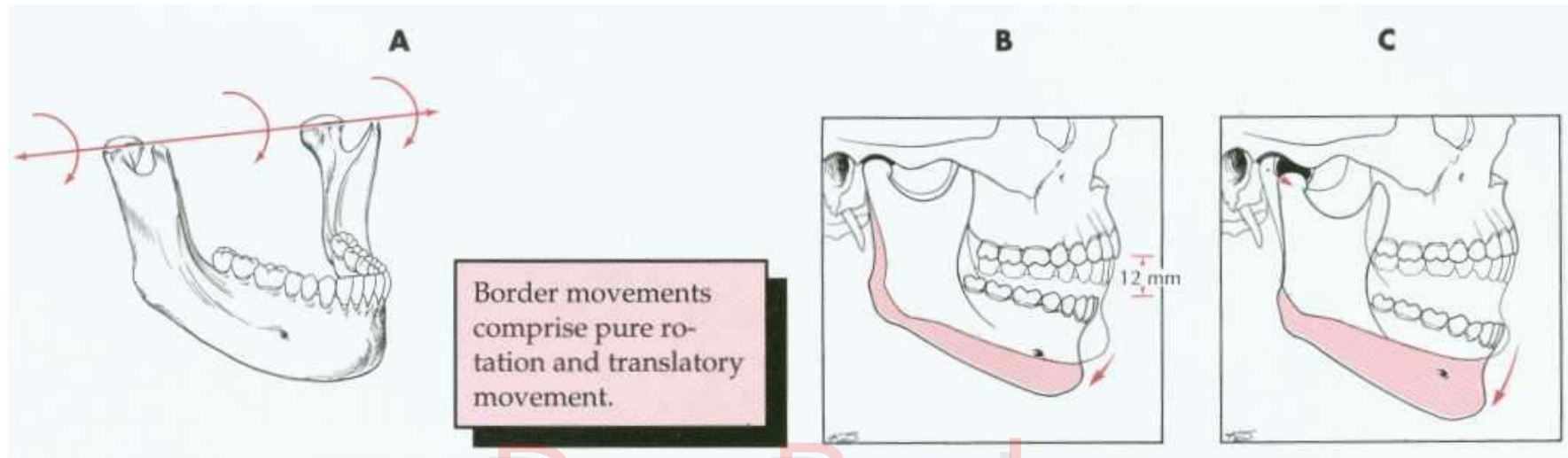
1- Opening

2- Protrusive

3- Lateral excursions: right and left

1- Opening movement

- The condylar rotates in place, in the terminal hinge position
- Upon **rotation** the condyle, the mandibule opens, and the teeth are disclosed
- As soon as the pure rotation ends, the condyle being to **translate**, moving forward and downward on superior and anterior walls of glenoid fossa till maximum opening position



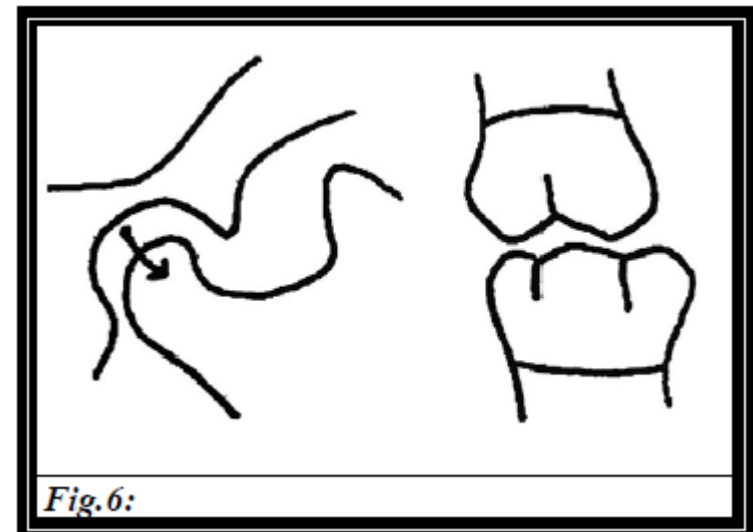
A . Rotation of the mandible in a sagittal plane can be made around the terminal hinge axis.

B . After about 12 mm of incisal opening, the mandible is forced to translate.

C . Maximum opening; the condyles have translated forward.

2- Protrusive movement

- The condyles follow the form of superior wall of the glenoid fossa, they slide downwards and forwards as the mandible moves in position.
- This movement causes the separation of posterior teeth (disclusion)



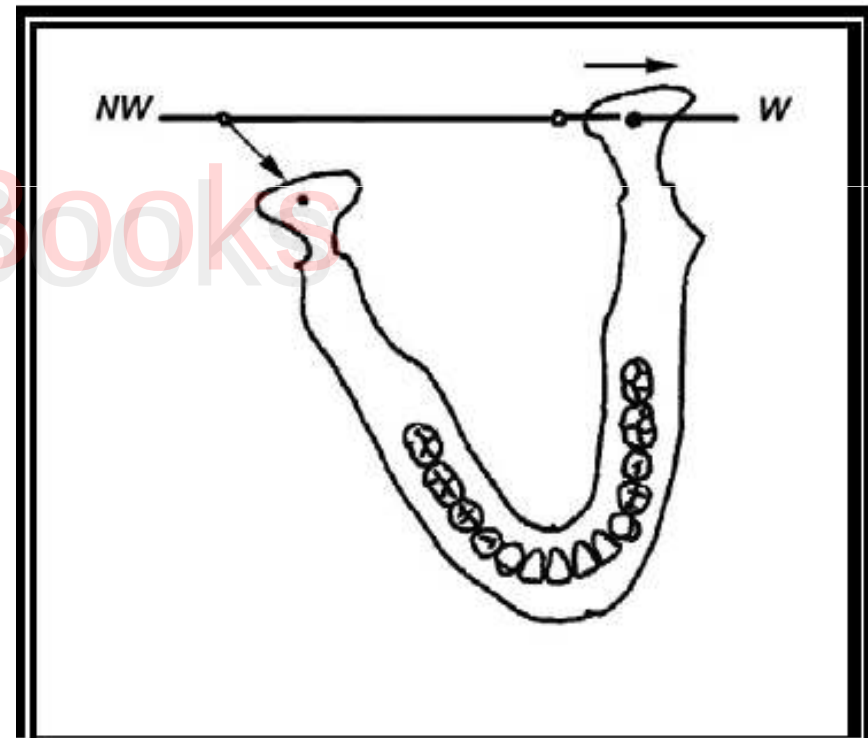
- During this movement, the opposing inclines of the teeth should not touch each other.
- The palatal cusps of the upper tooth travels distally from its centric positioning the central fossa of the lower opposing tooth, while the buccal of the lower travels mesially across the central groove of the upper opposing teeth

- The cusp angle should be in harmony with the angle that the condyle travels during the protrusive movement Or else a protrusive interference exist.
- The steeper this angle is the more allowable is the cuspal angle, the longer the cusps are the deeper the fossa

3- Lateral Excursion movement

- The mandible is capable of moving towards both the right and left sides.

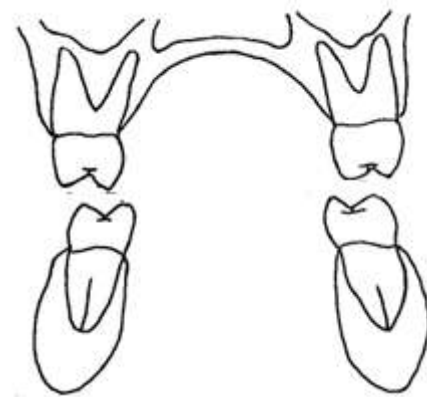
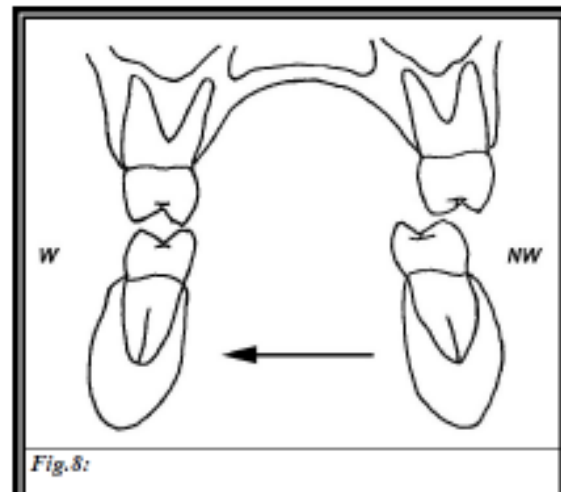
The side to which the mandible moves is called **the working side**, while the opposing side is called the **non-working side**



The working side

- This is the side on which we chew. The condyle on the working side is called the rotating condyle. It **rotates** in its fossa with a little downward and backward movement, rotating **against the superior and posterior walls** of the glenoid fossa

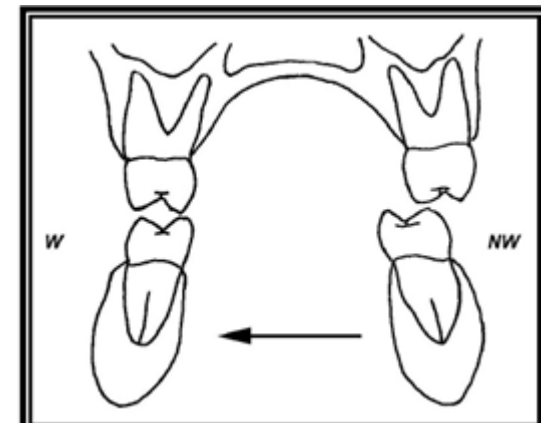
- The buccal cusps of upper and lower molars line up, with the lower buccal stamp cusp moving from its centric position in the fossa of the opposing upper tooth towards the buccal along the buccal groove.



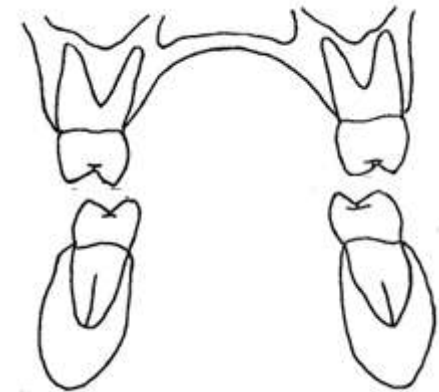
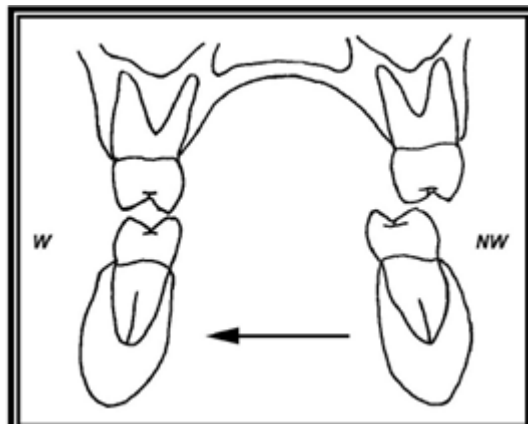
- During this movement, any contact that would exist between the lower buccal cusps or the upper palatal cusps with their opponents would be considered as working side interference

The Non-Working Side

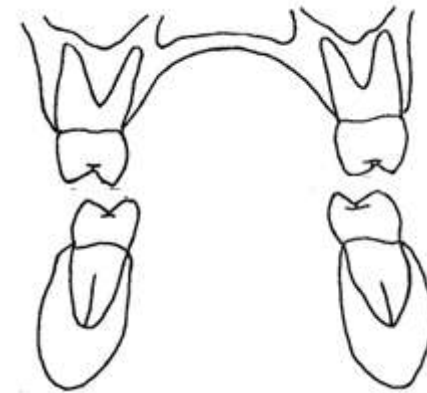
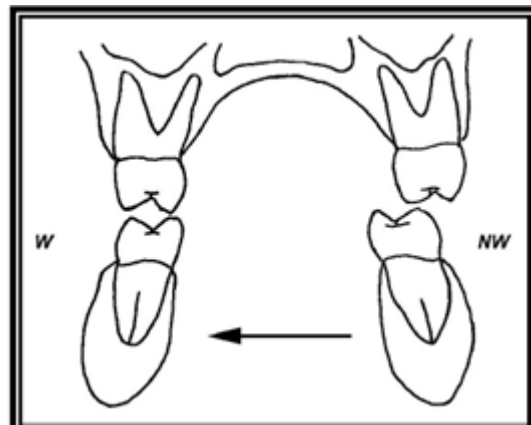
This is the side opposing to where we chew. **The condyle on the non-working** side is called the orbiting or translating condyle. It moves medially till it comes in contact with the medial wall of glenoid fossa, then moves **downwards, forwards and medially**, on the superior and medial wall of the fossa



- The palatal cusps of upper molars line up with the buccal cusps of lower molars
- The buccal cusps of the lower teeth moving lingually, from their centric position across the oblique grooves of their upper opponent, while the upper palatal cusps move buccally through the oblique grooves of their lower opponent



- During this movement, any contact that would exist between the lower buccal cusps or the upper palatal cusps with their opponents would be considered as non-working side interferences



Bennett Movement (Side Shift)

- This is lateral bodily movement of rotating (**working**) condyle, with medial movement of the orbiting (non-working or translating) condyle . **The medial wall of the glenoid fossa on the non-working side determines the amount of this movement.** The condyle moves medially till it is in contact with the medial wall

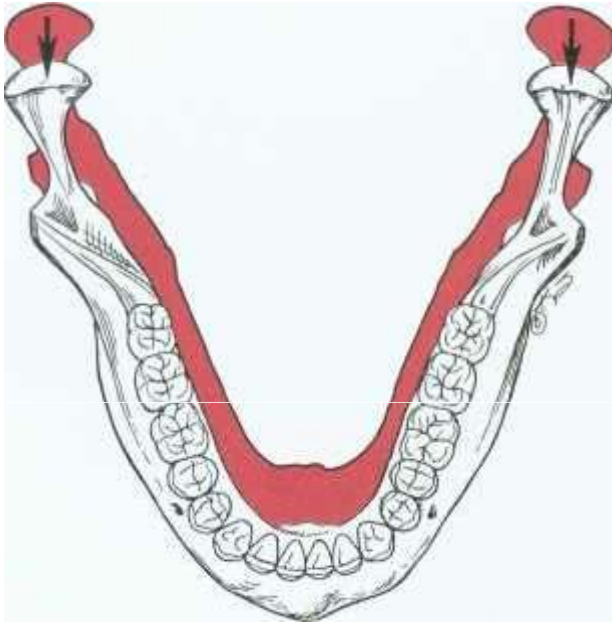
- The initial side shift:

occurs during the initial 2 mm of the anterior movement. The average initial side shift is 1.7 mm medially. There is more medial movement than there is anterior movement.

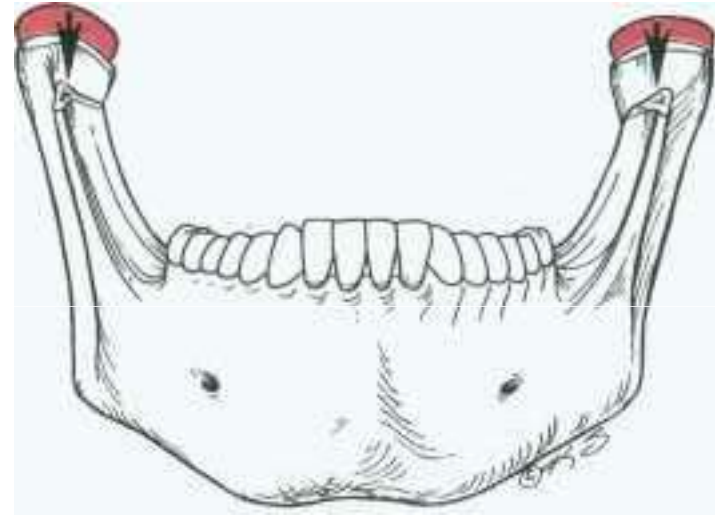
DropBooks

The progressive side shift: occurs after the initial side shift, the curve of the medial wall of the glenoid fossa begins to straighten, there is more anterior movement with little medial movement

The progressive side shift



Protrusive mandibular movement in the horizontal plane.



Protrusive movement in the frontal plane.

- Total side shift = Initial side shift + progressive side shift
- **The Bennett Angle: Is the angle formed between the mid-sagittal plain and the medial wall of the glinoid fossa on the non-working side (7-8 degrres)**

Determinants of Occlusion

1-The Posterior Determinants of Occlusion:

The effect of the anatomy of the TMJ on the mandibular movements and tooth morphology

The paths of the condyles take during their movements within the glenoid fossae, and the locations of the rotational centers determine the occlusal morphology of teeth. These have an effect on the allowable cusp height, fossa depth along with the acceptable ridge and groove directions.

Factors affecting posterior determinants of occlusion: (TMJ)

A- Protruding Condyle (Antero-posterior movement)

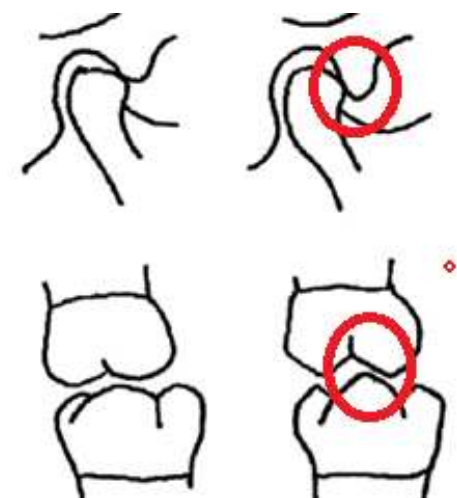
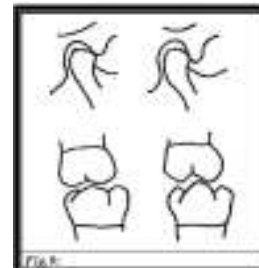
B-Rotating Condyle (Working Side movement)

C-Orbiting Condyle (Non-Working Movement)

D-Inter-Condylar Distance

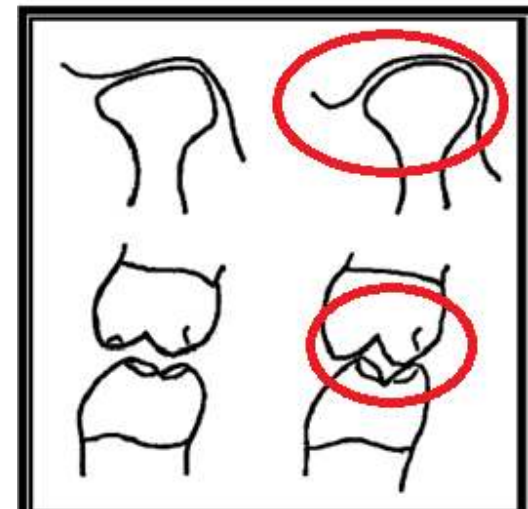
A- Protruding Condyle (Antero-posterior movement)

- In a protrusive movement, the condyle **rotates initially** and then **rotates and translates**, moving downwards and forwards guided by the angle of the articular eminence.
- The steeper the angle of the **articular eminence**, the more allowable cusp height, the steeper the cusp angles and the deeper the fossae

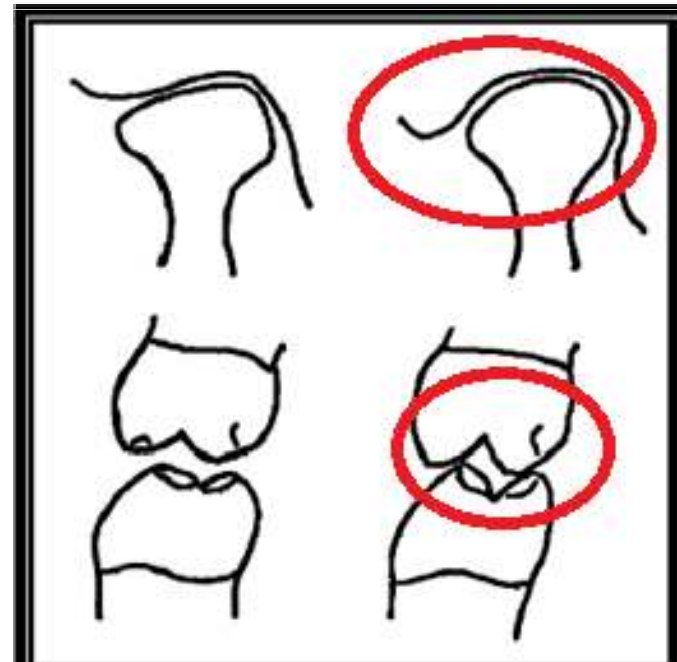


B-Rotating Condyle (Working Side movement)

- On the working side, the rotating condyle **rotates and translates** on the **posterior and superior walls of the fossa**. The stamp buccal cusp of the lower molar should be able to pass through the buccal working groove of the upper molar without contact, while the upper stamp palatal cusp of the upper pass without contact through the lower lingual working groove.

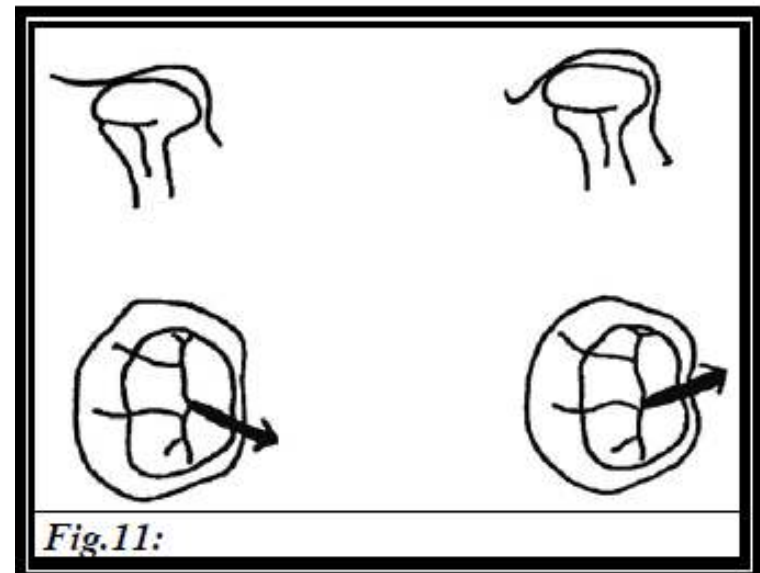


- From a Frontal view, the effect of the **superior wall of the** fossa can be seen. The steeper of the **superior wall**, the more the allowable **cusp height**, the steeper the cuspal angle and the deeper the fossae and the grooves.



A steeper angle of the superior wall would result in *Laterodetrusion* (***lateral and downward*** movement of the working condyle from its centric relation position), while a shallower angle would lead to a *Laterosurtrusion* (***lateral and upward*** movement).

- From the horizontal view, the effect of the **posterior wall of the** fossa can be seen. The steeper the angle of the posterior wall, the more distal is the lingual **groove** of the lower molar and the more mesial would be the buccal groove of the upper molar (The working groove). (fig 11)



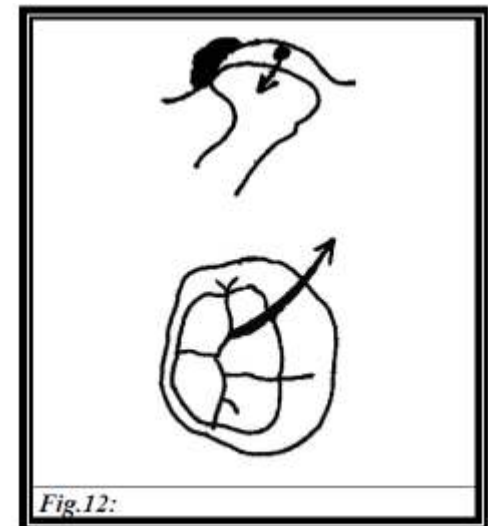
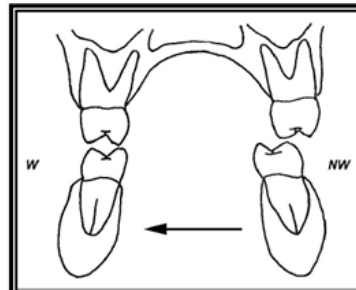
- The steeper angle of the posterior wall would lead to *Lateroprotrusion* (**lateral and forward** movement of the working condyle), while a shallower angle would result in *Lateroretrusion* (**lateral and backward** movement).

C-Orbiting Condyle (Non-Working Movement)

On the non-working side, the condyle moves medially, downwards and forwards, on the medial wall of the glenoid fossa.

The stamp buccal cusps of the lower molars move downwards, anteriorly and medially, passing through the oblique lingual Nonworking grooves of the upper molars **without contact**.

The upper palatal stamp cusps should pass through the lower oblique nonworking grooves, also **without contact**.

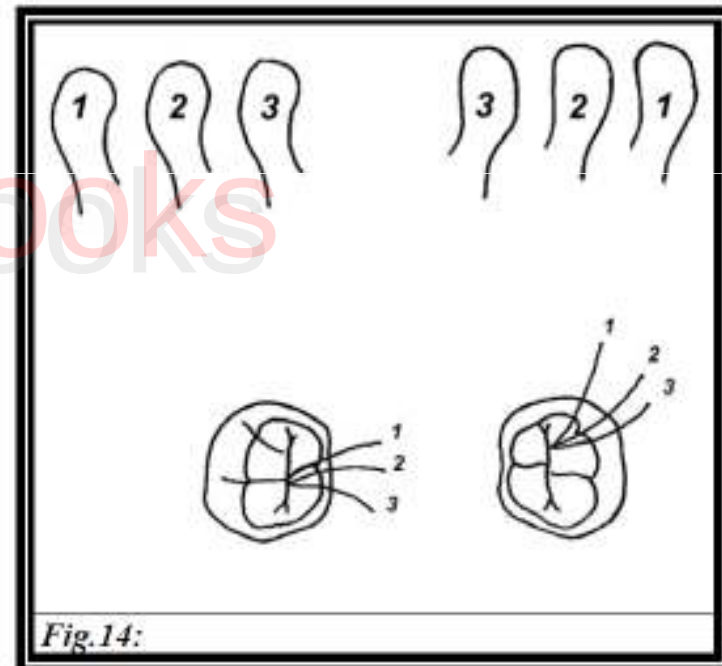


D-Inter-Condylar Distance

This refers to the distance between the rotational centers of both condyles.

The more the intercondylar distance, the more distal the grooves are in the lower molars, and the more mesial they are in the upper molars.

The lesser the intercondylar distance, the more mesial the grooves are in the lower molars, and the more distal they are in the upper molars.



2-The Anterior Determinants of Occlusion: (dentition)

- There are factors found within the **dentition** that capable of affecting the mandibular movements.

A-Occlusal Plane

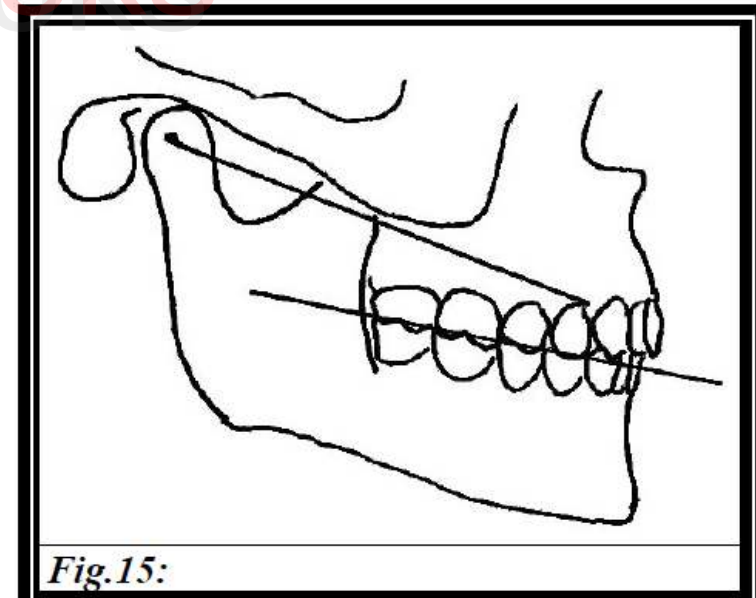
B-Curve of Spee

C-Facial Position of the Teeth

D-Vertical and Horizontal Overlap of the Anterior Teeth

A-Occlusal Plane

The more the plane of occlusion diverges from the path of the nonworking condyle, the greater is the allowable cusp height. The more parallel they are the shorter the cusps. (fig 15)

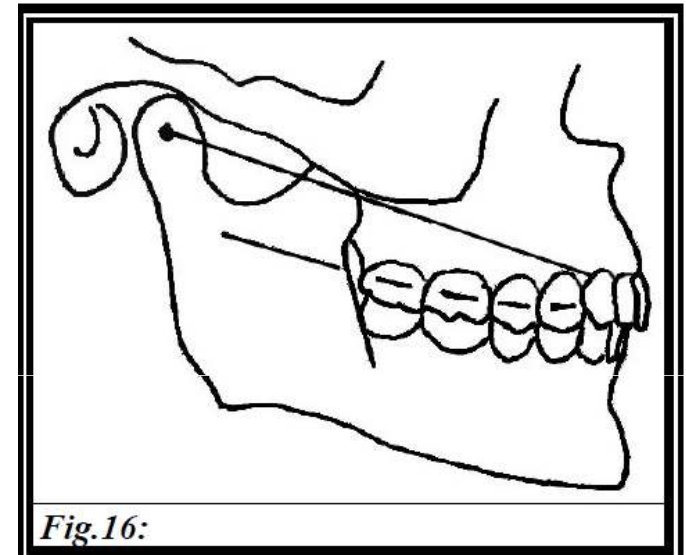


B-Curve of Spee

The effect of the curve of Spee differs from each tooth to another.

The effect depends on the plane of each individual tooth in the curve as it is compared to the path of the non-working condyle.

The more they diverge from each other, the greater the allowable cusp height



C-Facial Position of the Teeth

The more laterally the teeth are positioned in reference to the midline, the more distally the **grooves** are in the maxillary teeth and the more mesially in the mandibular teeth.

The more anteriorly the teeth are positioned in reference to the rotational centers, the more distally the grooves are in the maxillary teeth and the more mesially in the mandibular teeth.

D-Vertical and Horizontal Overlap of the Anterior Teeth

- The greater the **vertical** overlap, the **greater** is the allowable **cusp height** of the posterior teeth, while the greater the **horizontal** overlap of the anteriors, the **shorter** is the allowable **cusp height** of the posteriors.



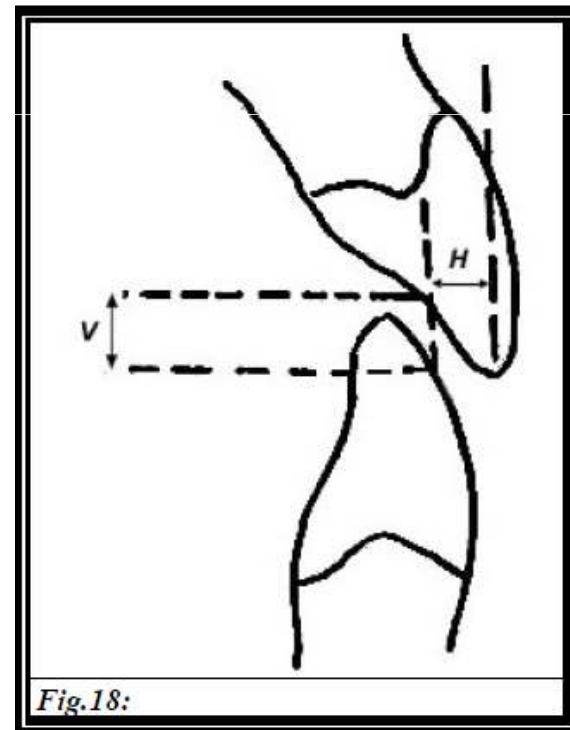
Occlusion of Teeth

Teeth are so arranged in our jaws such that forces of mastication would be transmitted along their long axes.

DropBooks

In addition the anterior teeth show a state of overlap in which the mandibular arch is contained within the maxillary arch.

This overlap may be either an ***Overbite (vertical overlap of the*** maxillary incisors over the mandibular incisors),
or an ***Overjet*** (horizontal overlap of the maxillary incisors over the mandibular incisors).



Incisal Guidance:

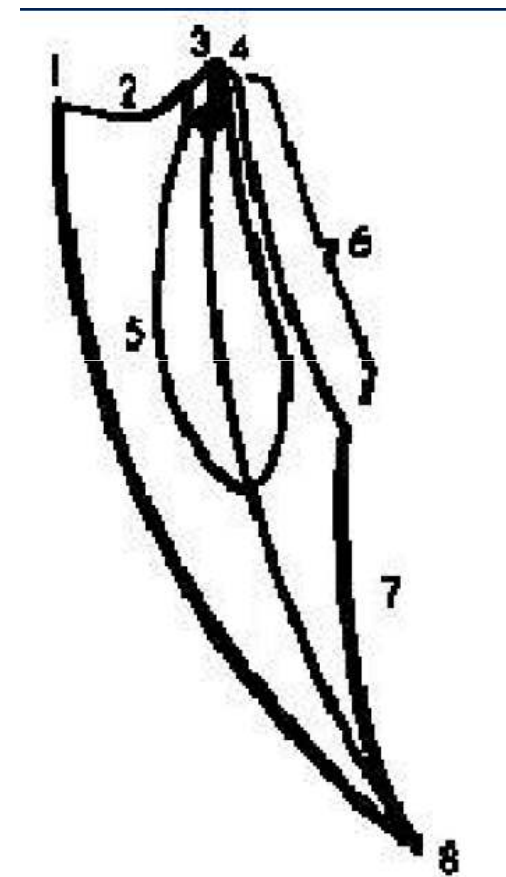
The incisal guidance is defined as **the inclination of the lingual surfaces of the upper six anterior teeth**. Both the horizontal and vertical Overjet and Overlap influence it.

The inclined planes of the posterior teeth must be in full coordination with the incisal guidance.

Posselt's Envelope of Motion

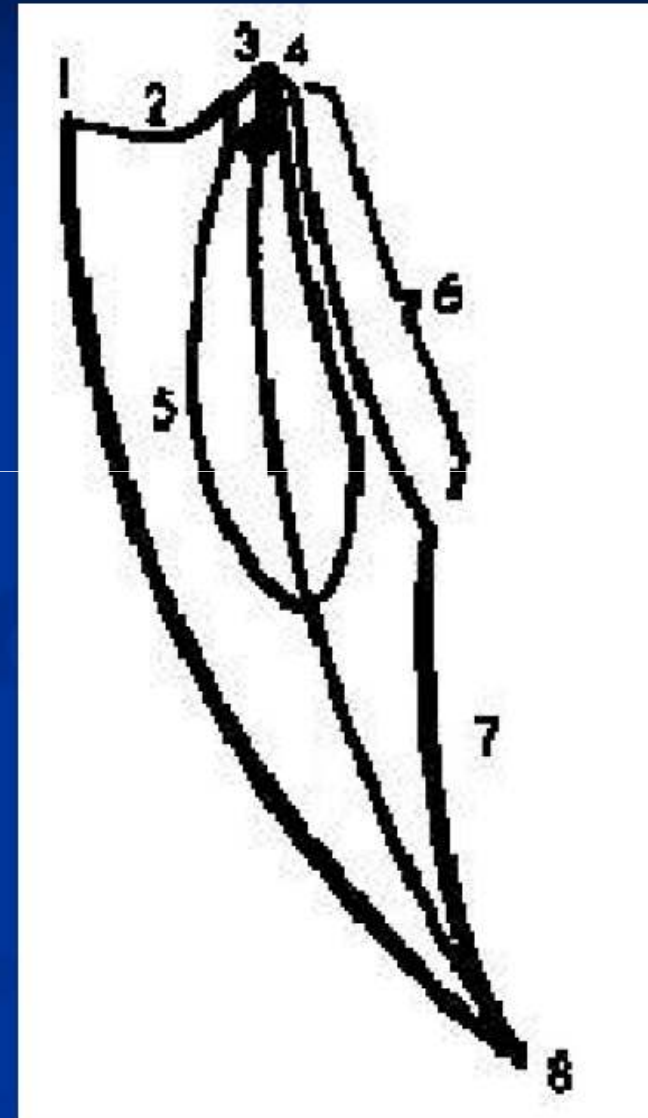
Posselt described the influence of tooth contact on mandibular movements. He traced a point on the incisal edge of a mandibular incisor. By this tracing, he came up with what is called *"Posselt's envelope of motion"*.

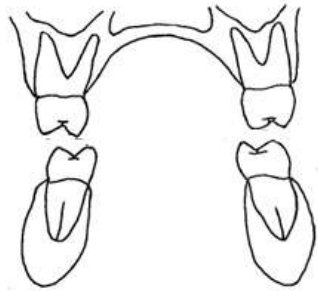
The upper extent of this envelope is a product of tooth contact, while the movements of the mandible along all other borders of the envelope and movements within it are without tooth contact, and are controlled by the cranio-mandibular articulation (TMJ), and the muscles of mastication. (fig 19)



Posselt's Envelope of Motion

- 1 = Maximum Protrusion (Protruded contact position)
- 2 = Edge to edge position of incisors
- 3 = Centric Occlusion (Maximum Intercuspal position)
- 4 = Centric Relation (Retruded contact position)
- Dot = Rest position
- 5 = Chewing stroke
- 6 = Rotation (Terminal Hinge Axis opening)
- 7 = Translation
- 8 = Maximum opening

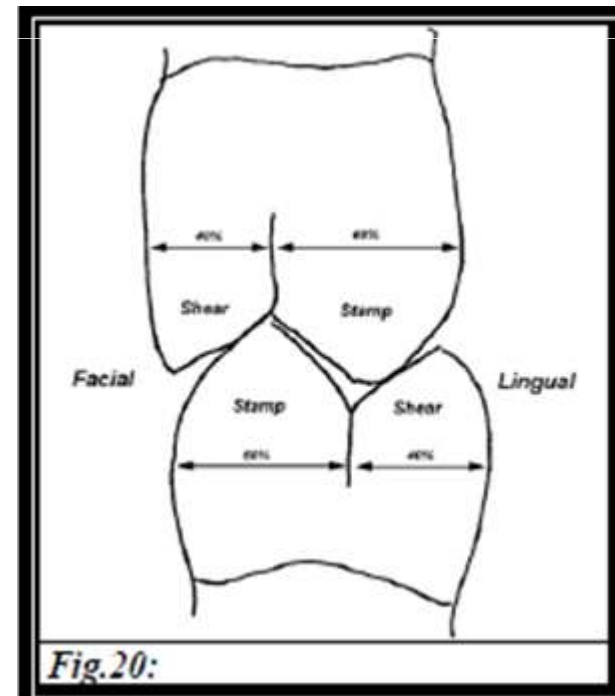
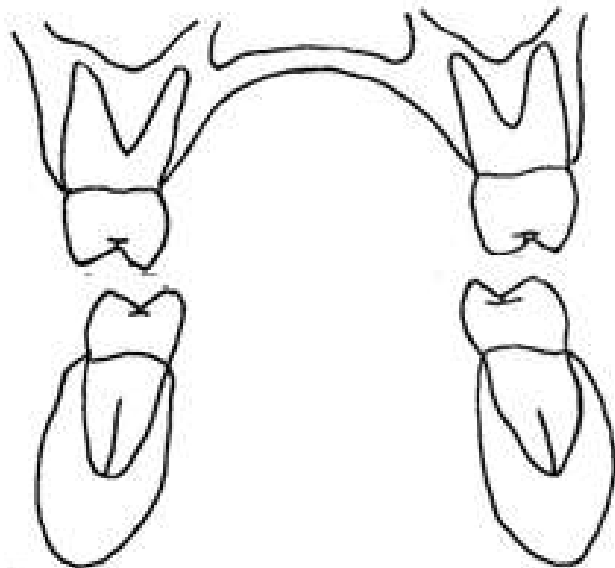




Occlusal Contacts:

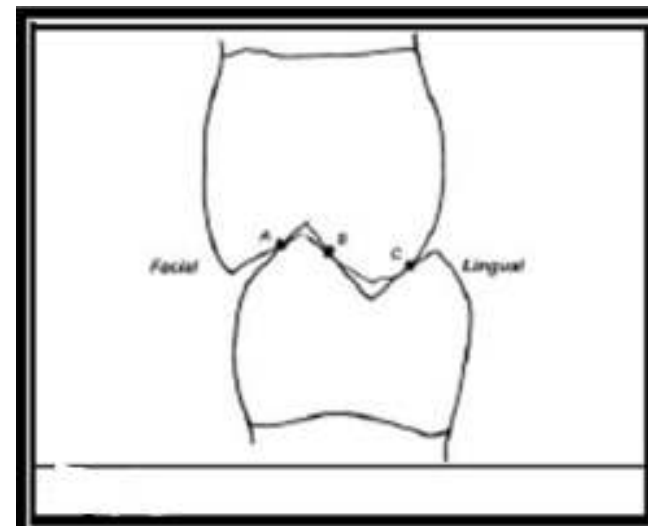
- From a coronal or frontal view of a section of the post canine teeth, the lingual cusps of the upper teeth stamp into the fossae of the lower teeth and the buccal cusps of the lower teeth stamp into the fossae of the upper teeth. The lingual cusps of the upper teeth and the buccal cusps of the lower teeth are therefore called ***Stamp Cusps***.
- The buccal cusps of the upper teeth and the lingual cusps of the lower are called the ***Shear Cusps, which is because they pass closely*** by the stamp cusps on their way to occlusion to shear the food.

A stamp cusp constitutes about 60% of the bucco-lingual dimension of a molar, while the shear cusp constitutes the remaining 40%.



-A , B , C Contacts

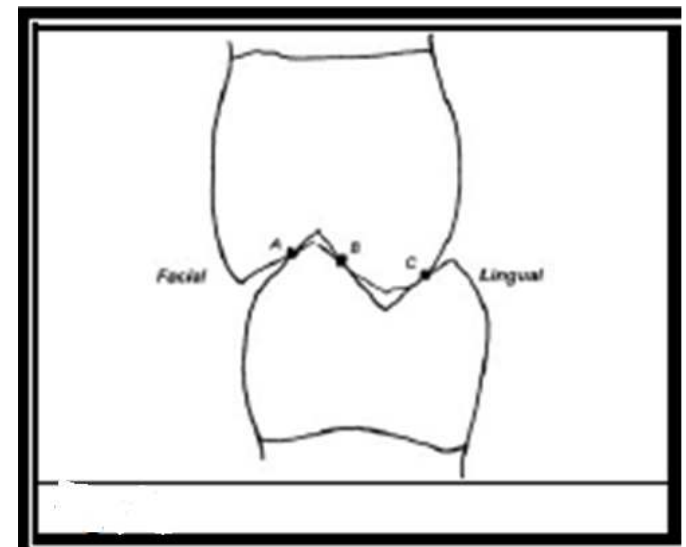
From the Frontal view, we will find a contact between the upper shearing buccal cusps and the lower buccal stamp cusps. This contact is called an ***A contact***. Any contact between the buccal cusps of the post canine teeth is an ***A contact***.



The contact between the lingual stamp cusp of the upper and the buccal stamp cusp of the lower is called a ***B contact***. ***In other words, the common contact between the stamp cusps is a ***B contact***.***

A third contact exists between the upper lingual stamp cusp and the lower lingual shear cusp. This is called a ***C contact***.

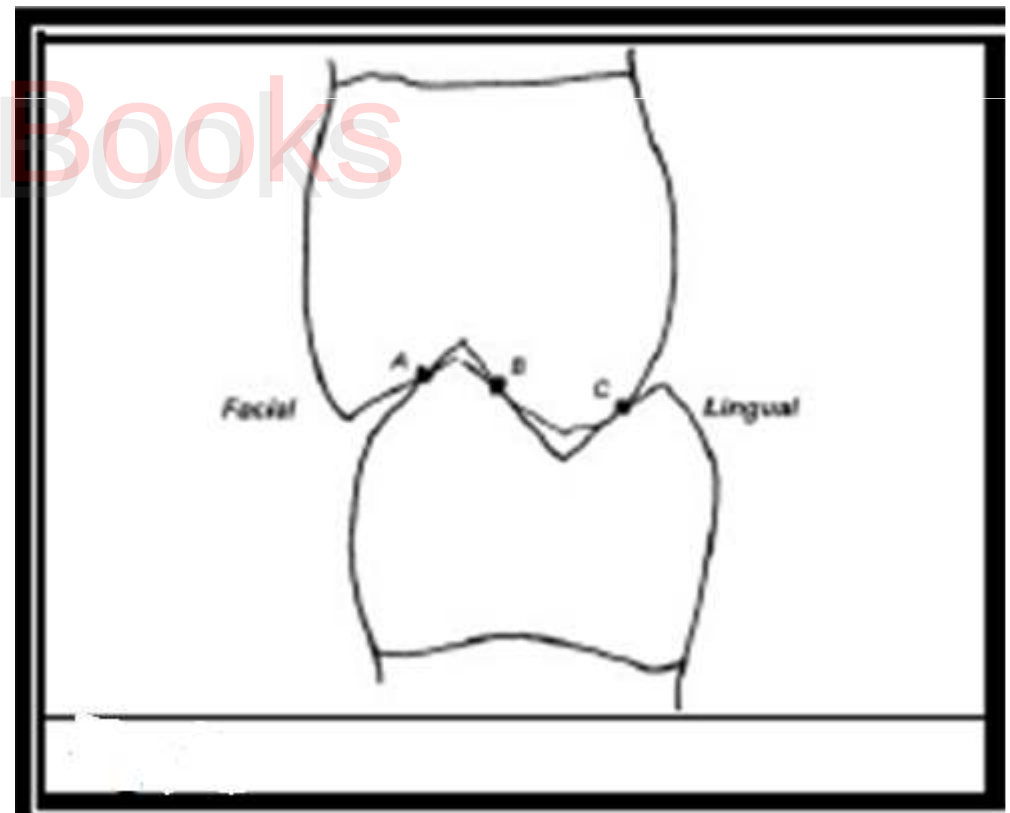
Any contact between the lingual cusps of the post canine teeth is a ***C contact***.



If we obtain an **A** and a **B** contacts in centric occlusion without the **C**, or if we obtain a **B** contact with a **C** contact without the **A**, we **will still have good stability**. This is because the closure forces will still be within the perimeter and in the long axis of the teeth. However, if we obtain an **A** and a **C** contacts without the **B** in centric, the parallelogram of force will be toward the buccal of the upper and the lingual of the lower.

In other words, if the **B** contact is not obtained, we will have a case of malocclusion, or an unstable centric

The B contacts are the most difficult to obtain and the most difficult to maintain and without them we have malocclusion.

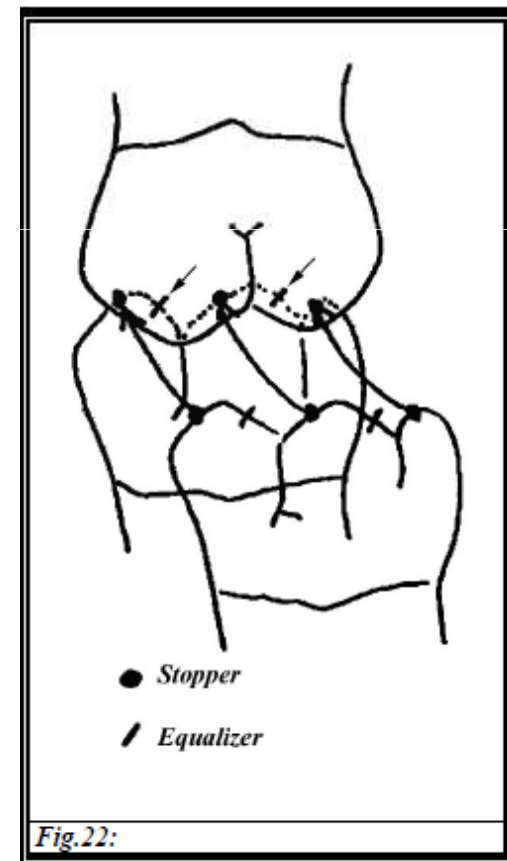


- ***Closure Stoppers and Equalizers:***

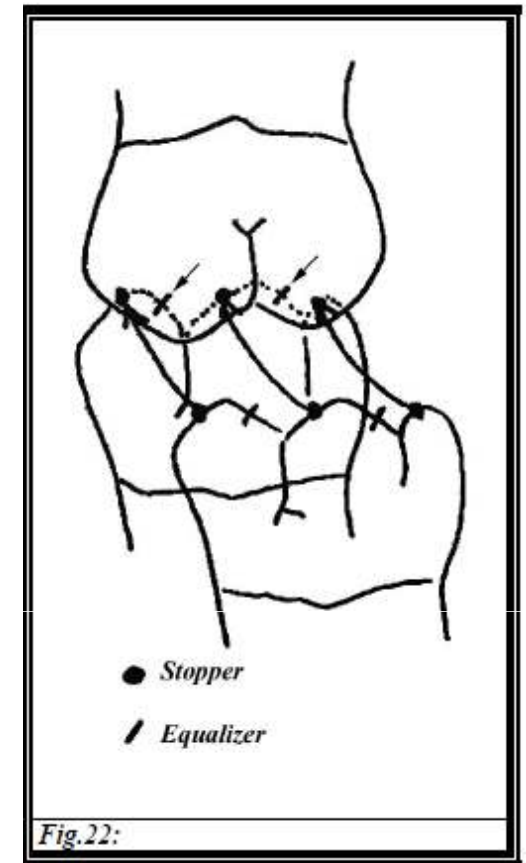
By looking from the Sagittal view, we will notice that the closure of the mandible does not occur in a straight upward movement but rather in a curve.

As the lower teeth come in contact with the upper teeth, contacts occur between mesial inclines of lower teeth and distal inclines of uppers.

These contacts are called: **Closure Stoppers**. This is actually what they do: they stop the closure of the mandible.



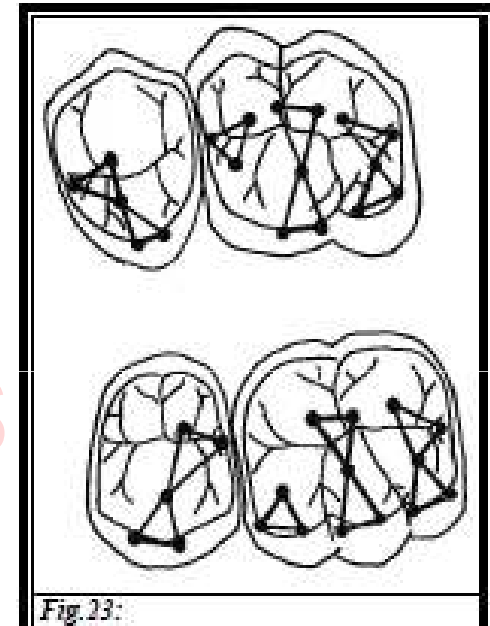
- At the same time, simultaneously, the distal inclines of the lowers come in contact with the mesial inclines of the uppers. These contacts are known as the **Equalizers**.



Their function is to equalize the stoppers so that torque would not be exerted on the teeth.

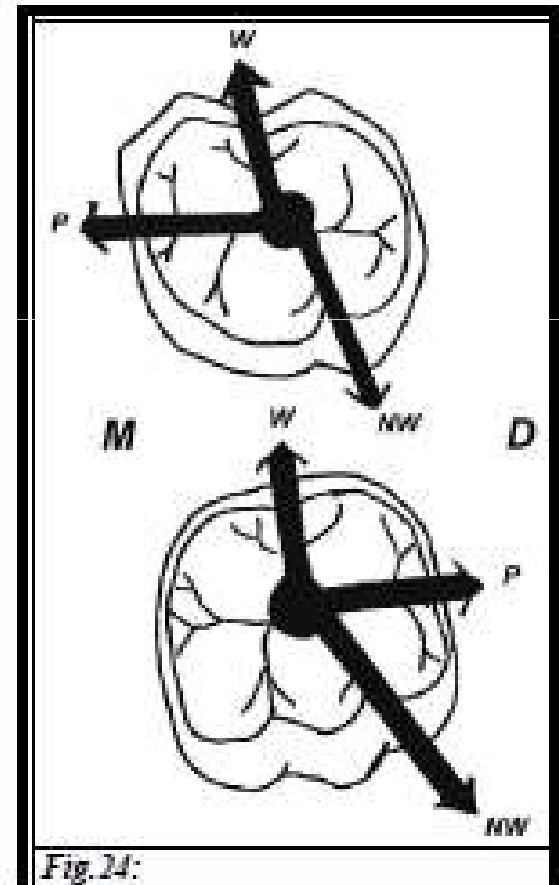
- If the closure of an Equalizer is simultaneous with the closure of the Closure Stopper, then the closure forces are equal and opposite. If the Equalizer contacts in closure before the Closure Stopper, the Equalizer becomes a deflector of the closure. It is very important to the interdigitation of the occlusion to have simultaneous contacts between the Equalizers and Closure Stoppers in Centric Occlusion.

- From a Horizontal view (fig 23), the closure stoppers, equalizers, A, B, and C contacts are so arranged in centric occlusion in such a way that they form pinpoint simultaneous contacts, in **Tripods** of three points of contacts in each fossa. These tripods of interocclusal contacts are immediately separated or discluded in any eccentric movements. Upon protrusive, right or left lateral movements, the centric contacts are immediately discluded into the depressions or grooves.



THE UNIT OF OCCLUSION

The unit of occlusion is a cusp in a fossa. This cusp has in its fossa a working groove through which it moves in a working movement. It also has an idling or nonworking groove through which it idles in a non-working movement when the opposite side is working. It also possesses an idling protrusive groove, through which it passes through during the protrusive Movement



These grooves serve as pathways in the fossae for their cusps to move freely and disclude in any eccentric movements.

The cusp in a fossa must have interocclusal contact: closure stoppers and equalizers in the sagittal plane, it must also have an A, B and a C interocclusal contacts in the frontal plane.

Looking on this contact from the horizontal plane a resultant three-point contact between the cusp and fossa should exist. This is what we call Tripodization of a cusp in a fossa; it supplies occlusion stability mesiodistally as well as bucco-lingually.

- ***“A TRIPODE IS THE MOST STABLE SYSTEM IN MECHANICS”***

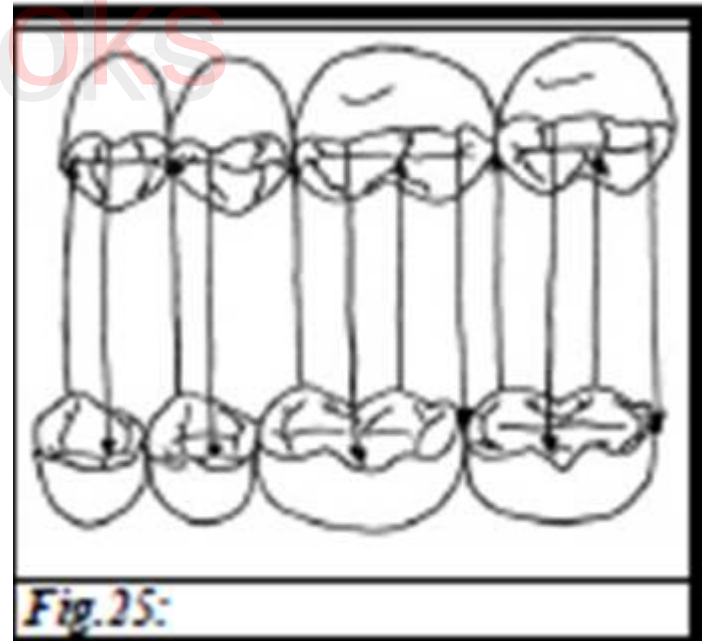
Static Occlusion

Types of Occlusion Relationship:

1-Cusp - Ridge Pattern of Occlusion:

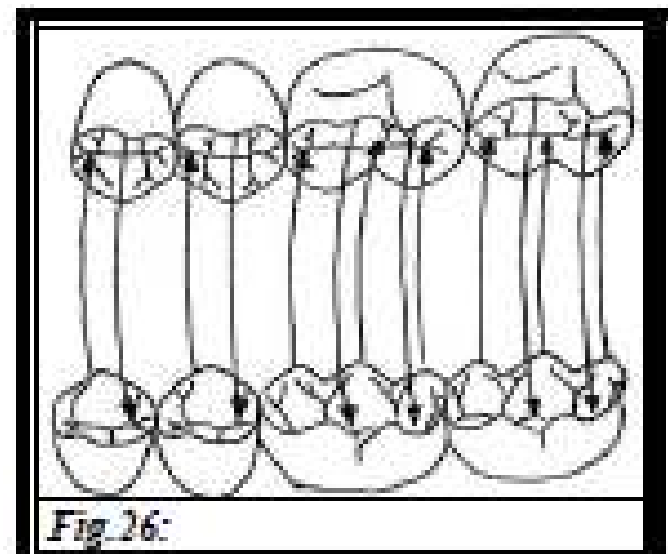
The relation between the upper and lower teeth is such that one stamp cusp fits in a fossa and another stamp cusp of the same tooth fits into the embrasure

area of two of the opposing teeth. This cusp-ridge arrangement is called a “tooth-to-two-teeth” occlusion, or a “cusp-embrasure” occlusal pattern .



2-Cusp-Fossa Pattern of Occlusion:

In this pattern, most or all of the stamp cusps fit into fossae. The “cusp -fossa” relationship normally produces an interdigitative relation of the cusps and fossae of one tooth with the cusps and fossae of only one tooth. This pattern may also be called “tooth-to-one-tooth” occlusion



Advantages of Cusp-Fossa over Cusp-Marginal Ridge Pattern of occlusion:

A cusp fossa relationship produces an **interlocking** of the upper and lower teeth, thus giving **maximum support in centric occlusion**. The forces are closer to the long axis of each tooth, giving a more **efficient chewing** apparatus.

The occlusal forces are along the long axes of teeth: less tipping. There is **elimination of food impaction between marginal ridges**. The teeth are more stable, with more stable occlusion.

Because the cusps make their contact with their ridges, not their tips, there is **lesser wear** of the cusp tips.

Dynamic Occlusion

Concepts of Occlusion:

1-Bilateral Balanced (5% of population)

Balanced occlusion is characterized by having all teeth in contact both in centric occlusion and during all eccentric mandibular movements. Since it has simultaneous tooth contacts during eccentric movements, all the teeth along with the TMJ share the lateral occlusal forces generated during these movements.

This theory was built on the basis that the forces generated are all horizontal rather than vertical. Since these lateral forces are harmful to the periodontium, and in order to reduce the lateral pressure, these forces need to be distributed as widely as possible to limit their harmful effect.

In order to produce a full balance, it is sometimes necessary to increase the vertical dimension to an intolerable limit.

This technique is both difficult to fabricate and to maintain.

To summarize:

- All teeth contact each other during centric and all eccentric movement.
- There is cross mouth and cross tooth contacts.
- It is not a healthy occlusion.
- Does not normally occur.
- Complete dentures are made with this type of occlusion for the purpose of stability.

2-Unilateral Balanced: (Group Function)(20-25%)

This type of occlusion is seen when all the facial ridges of teeth on the working side contact their opposites, while those on the nonworking side do not.

This concept is characterized by:

- 1-Applying the theory of Long Centric.
- 2-All working side teeth share lateral forces during lateral movements
- 3-Nonworking side teeth are free from contacts during lateral movements

It was felt that all working side teeth should share and bear the lateral pressures during lateral movements by eliminating the nonworking contacts. However, the pressure differences in molars as compared to anterior teeth were not thought of. The lateral pressure on a canine is approximately one-eighth that on a second molar. By that, a molar would bear a much greater burden than a canine, and as such, all teeth would not be sharing the same amount of load.

To summarize:

- On the working side: canine and post canine teeth are in contact with their opposites.
- On the nonworking side: no contacts exist between teeth.
- This type of occlusion is found naturally, and may cause wear and mobility.

Long Centric:

Long centric or “Freedom in Centric” is an occlusal concept, in which a flat region is built between the retruded position and the maximum intercuspation, without a change in the vertical dimension.

This flat region, having a length of 0.5-1mm, gives the mandible freedom to close in Centric or slightly anterior to it without any interference. Schuyler first introduced this concept in the 1930's. According to him the reasons for such a line of treatment were:

- 1-The fit of the condyle into the disc is not like the fit of a mechanical ball into its bearing, in other words, there is some front to back movement within the boundaries of the disc.

2-There is a difference that exists between a firm and a light closure. In a firm closure there is strong contraction of the elevator muscles pulling the condyles to the back of the disc. In a light closure, there is insufficient pull by the muscles to completely place the condyle at the back of the disc. These leads to a situation where there is a difference between the firm and light terminal hinge closures.

3-There is a difference in closure according to the patient's posture.

Cases that need Freedom in Centric:

- When teeth are in the way if the patients close normally, but are fine when the mandible is pushed to the back.
- When teeth are fine when laying down, but are in the way while sitting upright.

If a patient needs long centric and does not get it, the lower incisors will strike the lingual inclines of the upper incisors causing instability, followed by bruxism and clenching.

3-Cuspid Protected: (Mutually Protected)(60-70%)

This type of occlusion occurs when the posterior teeth protect the anterior teeth in centric position. The centric stops on the posterior teeth also prevent excess loading to be transferred to the TMJ.

The anterior teeth protect the canine and the posterior teeth during the protrusive movement, while the canine protects the incisors and posterior teeth during lateral movements.

D'Amico advocated the Canine guided occlusion in 1958, after performing studies on the canines in animals and humans. He considered the canine as being the key of occlusion.

This was based on the facts that:

- 1-The canine has a good, if not superb, crown-root ratio.
- 2-The presence of the canine eminence formed of hard compact bone surrounding the tooth.
- 3-The location of the canine being far from the TMJ, thus receiving less stress.
- 4-The canine has many receptors in the periodontium

To summarize:

- Posterior teeth are in contact in the centric position.
- Anterior teeth guide the mandible in the protrusive movement.
- Canines guide the mandible in the lateral movements.
- Posterior teeth are separated and are **not in contact in all** eccentric movements.

Organic Occlusion:

This is a therapeutic type occlusion that was introduced by Stuart and Stallard in 1972, as an approach for treatment in full mouth reconstructions.

Stuart and Stallard studied patients over 60 years of age, without attrition and studied their occlusion.

It was observed that molars did not contact during eccentric movements but only in maximum intercuspation, while the anterior teeth had no contacts. The molars were responsible for bearing the vertical occlusal loads.

It was concluded that anterior teeth protect the posterior teeth and the posterior teeth protect the anteriors.

The criteria set forth were: Cuspid protected occlusion.

1- Cusp-Fossa relation

2- Simultaneous contact of posterior teeth in centric.

3- Anterior teeth are in contact in the protrusive movement.

4- Tripoding of the stamp cusps as they occlude in their opposing fossae.

Thank you

Relationship between anterior and posterior controlling factors

Table 6-1

Vertical determinants of occlusal morphology (cusp height and fossa depth)

Factor	Condition	Effect
Condylar guidance	Steeper the guidance	Taller the posterior cusps
Anterior guidance	Greater the vertical overlap	Taller the posterior cusps
	Greater the horizontal overlap	Shorter the posterior cusps
Plane of occlusion	More parallel the plane to condylar guidance	Shorter the posterior cusps
Curve of Spee	More acute the curve	Shorter the most posterior cusps
Lateral translation movement	Greater the movement	Shorter the posterior cusps
	More superior the movement of rotating condyle	Shorter the posterior cusps
	Greater the immediate sideshift	Shorter the posterior cusps

Table 6-2

Horizontal determinants of occlusal morphology (ridge and groove direction)

Factor	Condition	Effect
Distance from rotating condyle	Greater the distance	Wider the angle between laterotrusive and mediotrusive pathways
Distance from midsagittal plane	Greater the distance	Wider the angle between laterotrusive and mediotrusive pathways
Lateral translation movement	Greater the movement	Wider the angle between laterotrusive and mediotrusive pathways
Intercondylar distance	Greater the distance	Smaller the angle between laterotrusive and mediotrusive pathways